

## ABSTRACT OF THE DISCLOSURE

Embodiments for the invention include a process for the production of hydrogen comprising a protic solution, a photocatalyst capable of a two electron reduction of hydrogen ions; and a coproduct trap. The embodiment includes exposing the reaction medium to radiation capable of photoexciting the photocatalyst to produce hydrogen. The protic solution may comprise at least one of hydrohalic acid, a silane, and water and the hydrohalic acid may be hydrochloric acid, hydrogen bromide, hydrogen fluoride or hydrogen iodide.

The present application also describes novel transition metal compounds. Embodiments of the compounds include a compound comprising two transition metal atoms, wherein the transition metal atoms are in a two electron mixed valence state and at least one transition metal is not rhodium; and at least one ligand capable of stabilizing the transition metal atom in a two electron mixed valence state.